

# Next3D: Generative Neural Texture Rasterization for 3D-Aware Head Avatars

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## Abstract

3D-aware generative adversarial networks (GANs) synthesize high-fidelity and multi-view-consistent facial images using only collections of single-view 2D imagery. Towards fine-grained control over facial attributes, recent efforts incorporate 3D Morphable Face Model (3DMM) to describe deformation in generative radiance fields either explicitly or implicitly. Explicit methods provide fine-grained expression control but cannot handle topological changes caused by hair and accessories, while implicit ones can model varied topologies but have limited generalization caused by the unconstrained deformation fields. We propose a novel 3D GAN framework for unsupervised learning of generative, high-quality and 3D-consistent facial avatars from unstructured 2D images. To achieve both deformation accuracy and topological flexibility, we propose a 3D representation called Generative Texture-Rasterized Tri-planes. The proposed representation learns Generative Neural Textures on top of parametric mesh templates and then projects them into three orthogonal-viewed feature planes through rasterization, forming a tri-plane feature representation for volume rendering. In this way, we combine both fine-grained expression control of mesh-guided explicit deformation and the flexibility of implicit volumetric representation. We further propose specific modules for modeling mouth interior which is not taken into account by 3DMM. Our method demonstrates state-of-the-art 3D-aware synthesis quality and animation ability through extensive experiments. Furthermore, serving as 3D prior, our animatable 3D representation boosts multiple applications including one-shot facial avatars and 3D-aware stylization. Project page: <https://mrtornado24.github.io/Next3D/>. Code: <https://github.com/MrTornado24/Next3D>.